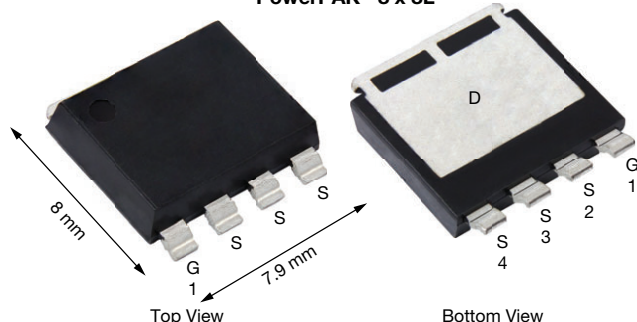


# Automotive N-Channel 40 V (D-S) 175 °C MOSFET

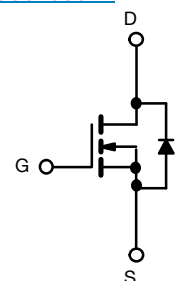
**PowerPAK® 8 x 8L**


## FEATURES

- TrenchFET® Gen IV power MOSFET
- AEC-Q101 qualified
- 100 %  $R_g$  and UIS tested
- Thin 1.6 mm package
- Very low thermal resistance
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**



N-Channel MOSFET

## PRODUCT SUMMARY

|                                              |                 |
|----------------------------------------------|-----------------|
| $V_{DS}$ (V)                                 | 40              |
| $R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10$ V | 0.0016          |
| $I_D$ (A)                                    | 375             |
| Configuration                                | Single          |
| Package                                      | PowerPAK 8 x 8L |

## ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)

| PARAMETER                                                 | SYMBOL         | LIMIT          | UNIT |
|-----------------------------------------------------------|----------------|----------------|------|
| Drain-source voltage                                      | $V_{DS}$       | 40             | V    |
| Gate-source voltage                                       | $V_{GS}$       | $\pm 20$       |      |
| Continuous drain current                                  | $I_D$          | $T_C = 25$ °C  | A    |
|                                                           |                | $T_C = 125$ °C |      |
| Continuous source current (diode conduction)              | $I_S$          | 195            |      |
| Pulsed drain current <sup>b</sup>                         | $I_{DM}$       | 750            |      |
| Single pulse avalanche current                            | $I_{AS}$       | 35             |      |
| Single pulse avalanche energy                             | $E_{AS}$       | 61             | mJ   |
| Maximum power dissipation                                 | $P_D$          | $T_C = 25$ °C  | W    |
|                                                           |                | $T_C = 125$ °C |      |
| Operating junction and storage temperature range          | $T_J, T_{stg}$ | -55 to +175    | °C   |
| Soldering recommendations (peak temperature) <sup>d</sup> |                | 260            |      |

## THERMAL RESISTANCE RATINGS

| PARAMETER                | SYMBOL     | LIMIT | UNIT |
|--------------------------|------------|-------|------|
| Junction-to-ambient      | $R_{thJA}$ | 44    | °C/W |
| Junction-to-case (drain) | $R_{thJC}$ | 0.38  |      |

### Notes

- Package limited
- Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %
- When mounted on 1" square PCB (FR4 material)
- See solder profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection



| SPECIFICATIONS (T <sub>C</sub> = 25 °C, unless otherwise noted) |                     |                                                                                                                      |                                                 |      |        |        |      |
|-----------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------|--------|--------|------|
| PARAMETER                                                       | SYMBOL              | TEST CONDITIONS                                                                                                      |                                                 | MIN. | TYP.   | MAX.   | UNIT |
| Static                                                          |                     |                                                                                                                      |                                                 |      |        |        |      |
| Drain-source breakdown voltage                                  | V <sub>DS</sub>     | V <sub>GS</sub> = 0, I <sub>D</sub> = 250 μA                                                                         |                                                 | 40   | -      | -      | V    |
| Gate-source threshold voltage                                   | V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                          |                                                 | 2    | 3      | 3.5    |      |
| Gate-source leakage                                             | I <sub>GSS</sub>    | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V                                                                      |                                                 | -    | -      | ± 100  | nA   |
| Zero gate voltage drain current                                 | I <sub>DSS</sub>    | V <sub>GS</sub> = 0 V                                                                                                | V <sub>DS</sub> = 40 V                          | -    | -      | 1      | μA   |
|                                                                 |                     | V <sub>GS</sub> = 0 V                                                                                                | V <sub>DS</sub> = 40 V, T <sub>J</sub> = 125 °C | -    | -      | 200    |      |
|                                                                 |                     | V <sub>GS</sub> = 0 V                                                                                                | V <sub>DS</sub> = 40 V, T <sub>J</sub> = 175 °C | -    | -      | 330    |      |
| On-state drain current <sup>a</sup>                             | I <sub>D(on)</sub>  | V <sub>GS</sub> = 10 V                                                                                               | V <sub>DS</sub> ≥ 5 V                           | 100  | -      | -      | A    |
| Drain-source on-state resistance <sup>a</sup>                   | R <sub>DS(on)</sub> | V <sub>GS</sub> = 10 V                                                                                               | I <sub>D</sub> = 20 A                           | -    | 0.0013 | 0.0016 | Ω    |
|                                                                 |                     | V <sub>GS</sub> = 10 V                                                                                               | I <sub>D</sub> = 20 A, T <sub>J</sub> = 125 °C  | -    | -      | 0.0024 |      |
|                                                                 |                     | V <sub>GS</sub> = 10 V                                                                                               | I <sub>D</sub> = 20 A, T <sub>J</sub> = 175 °C  | -    | -      | 0.0028 |      |
| Forward transconductance <sup>b</sup>                           | g <sub>fs</sub>     | V <sub>DS</sub> = 15 V, I <sub>D</sub> = 60 A                                                                        |                                                 | -    | 160    | -      | S    |
| Dynamic <sup>b</sup>                                            |                     |                                                                                                                      |                                                 |      |        |        |      |
| Input capacitance                                               | C <sub>iss</sub>    | V <sub>GS</sub> = 0 V                                                                                                | V <sub>DS</sub> = 25 V, f = 1 MHz               | -    | 3950   | 4930   | pF   |
| Output capacitance                                              | C <sub>oss</sub>    |                                                                                                                      |                                                 | -    | 1450   | 1810   |      |
| Reverse transfer capacitance                                    | C <sub>rss</sub>    |                                                                                                                      |                                                 | -    | 77     | 100    |      |
| Total gate charge <sup>c</sup>                                  | Q <sub>g</sub>      | V <sub>GS</sub> = 10 V                                                                                               | V <sub>DS</sub> = 20 V, I <sub>D</sub> = 30 A   | -    | 69     | 86     | nC   |
| Gate-source charge <sup>c</sup>                                 | Q <sub>gs</sub>     |                                                                                                                      |                                                 | -    | 35     | -      |      |
| Gate-drain charge <sup>c</sup>                                  | Q <sub>gd</sub>     |                                                                                                                      |                                                 | -    | 24     | -      |      |
| Gate resistance                                                 | R <sub>g</sub>      | f = 1 MHz                                                                                                            |                                                 | 0.8  | 1.6    | 2.6    | Ω    |
| Turn-on delay time <sup>c</sup>                                 | t <sub>d(on)</sub>  | V <sub>DD</sub> = 20 V, R <sub>L</sub> = 1 Ω<br>I <sub>D</sub> ≅ 20 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω |                                                 | -    | 17     | 24     | ns   |
| Rise time <sup>c</sup>                                          | t <sub>r</sub>      |                                                                                                                      |                                                 | -    | 41     | 57     |      |
| Turn-off delay time <sup>c</sup>                                | t <sub>d(off)</sub> |                                                                                                                      |                                                 | -    | 32     | 44     |      |
| Fall time <sup>c</sup>                                          | t <sub>f</sub>      |                                                                                                                      |                                                 | -    | 12     | 17     |      |
| Source-Drain Diode Ratings and Characteristics <sup>b</sup>     |                     |                                                                                                                      |                                                 |      |        |        |      |
| Reverse recovery time                                           | t <sub>rr</sub>     | V <sub>DD</sub> = 32 V, I <sub>FM</sub> = 15 A,<br>di/dt = 100 A/μs                                                  |                                                 | -    | 45     | -      | ns   |
| Reverse recovery charge                                         | Q <sub>rr</sub>     |                                                                                                                      |                                                 | -    | 39     | -      | nC   |
| Reverse recovery current                                        | I <sub>RM</sub>     |                                                                                                                      |                                                 | -    | -      | 2.1    | A    |
| Pulsed current <sup>a</sup>                                     | I <sub>SM</sub>     |                                                                                                                      |                                                 | -    | -      | 1600   | A    |
| Forward voltage                                                 | V <sub>SD</sub>     | I <sub>F</sub> = 50 A, V <sub>GS</sub> = 0                                                                           |                                                 | -    | 0.8    | 1.1    | V    |

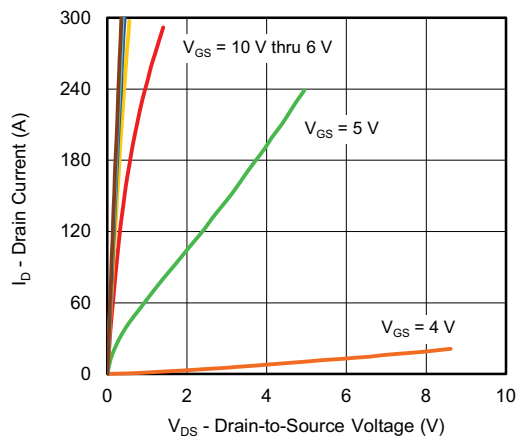
**Notes**

- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$   
b. Guaranteed by design, not subject to production testing  
c. Independent of operating temperature

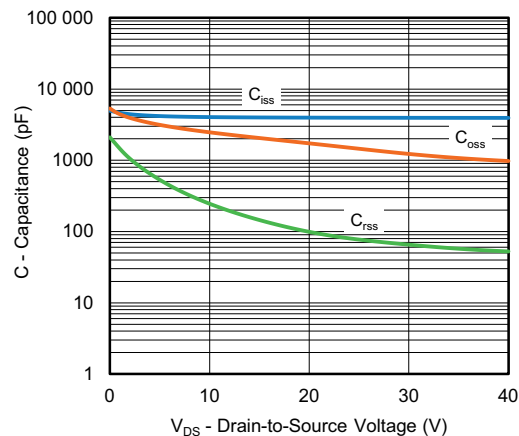
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



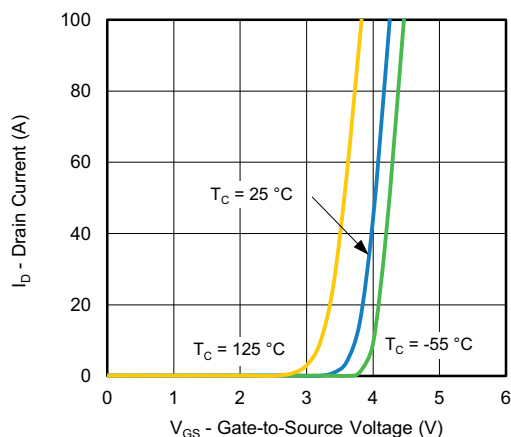
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



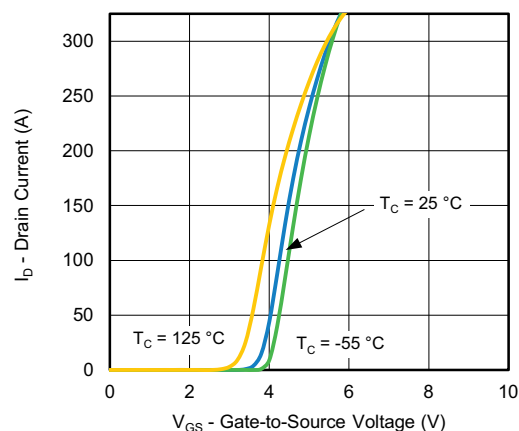
**Output Characteristics**



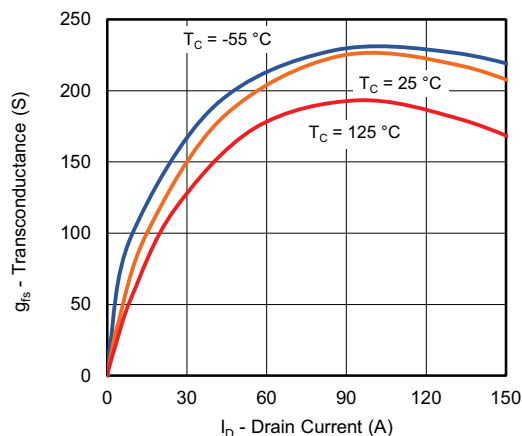
**Capacitance**



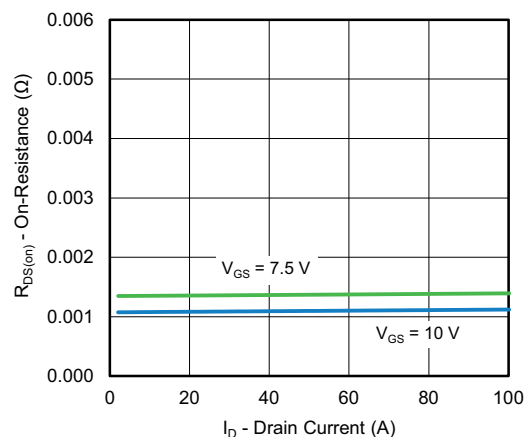
**Transfer Characteristics**



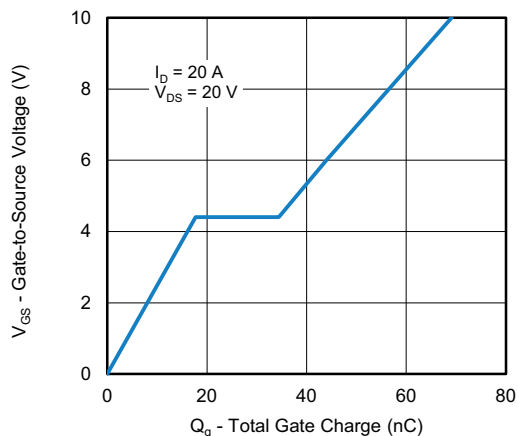
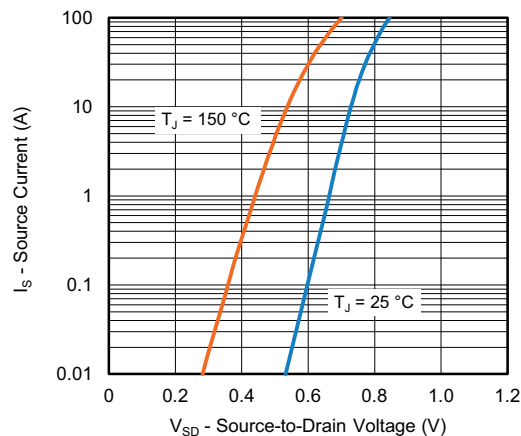
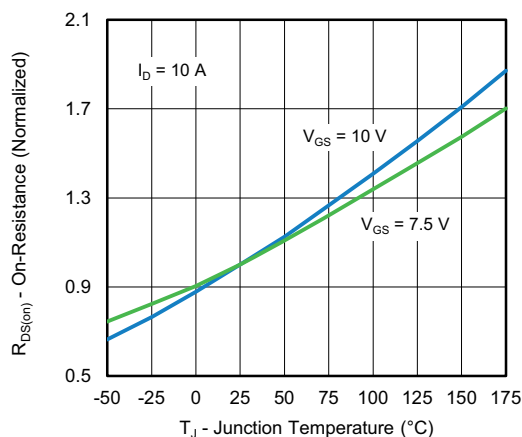
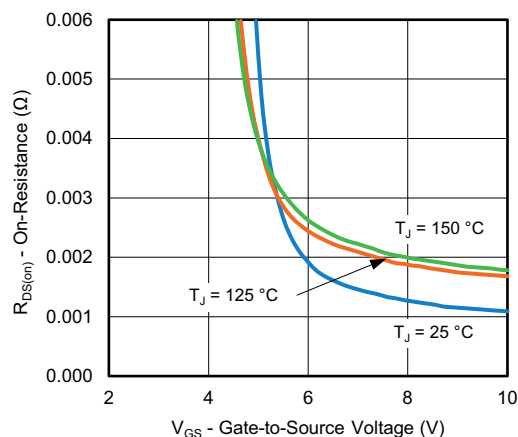
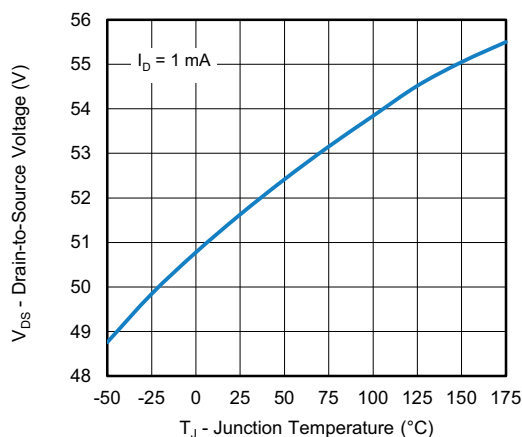
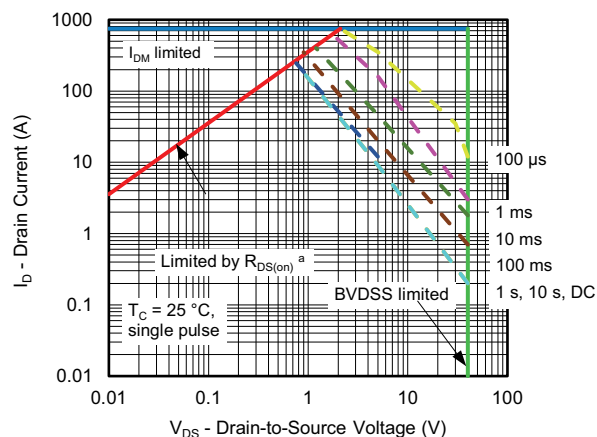
**Transfer Characteristics**



**Transconductance**



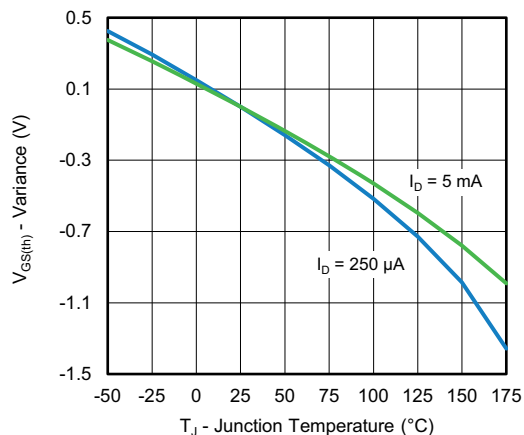
**On-Resistance vs. Drain Current**

**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

**Gate Charge**

**Source Drain Diode Forward Voltage**

**On-Resistance vs. Junction Temperature**

**On-Resistance vs. Gate-to-Source Voltage**

**Drain Source Breakdown vs. Junction Temperature**

**Safe Operating Area**
**Note**

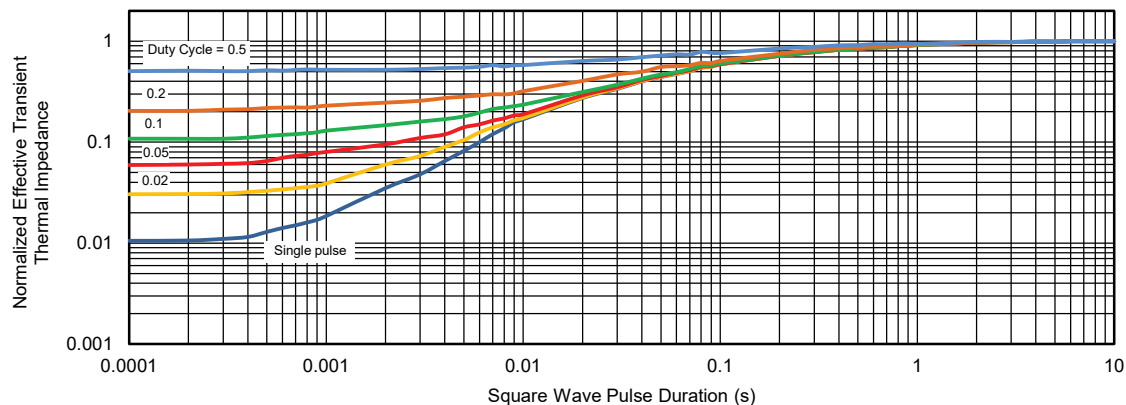
- $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified



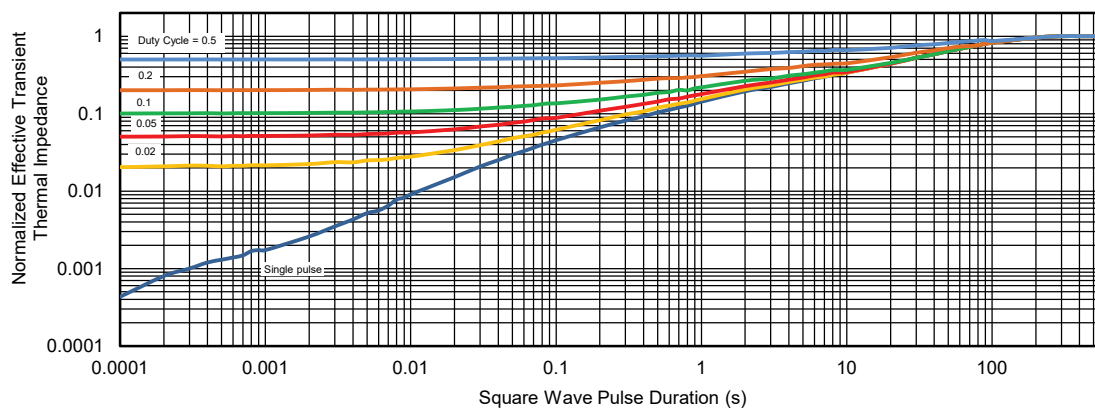
**THERMAL RATINGS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



Threshold Voltage



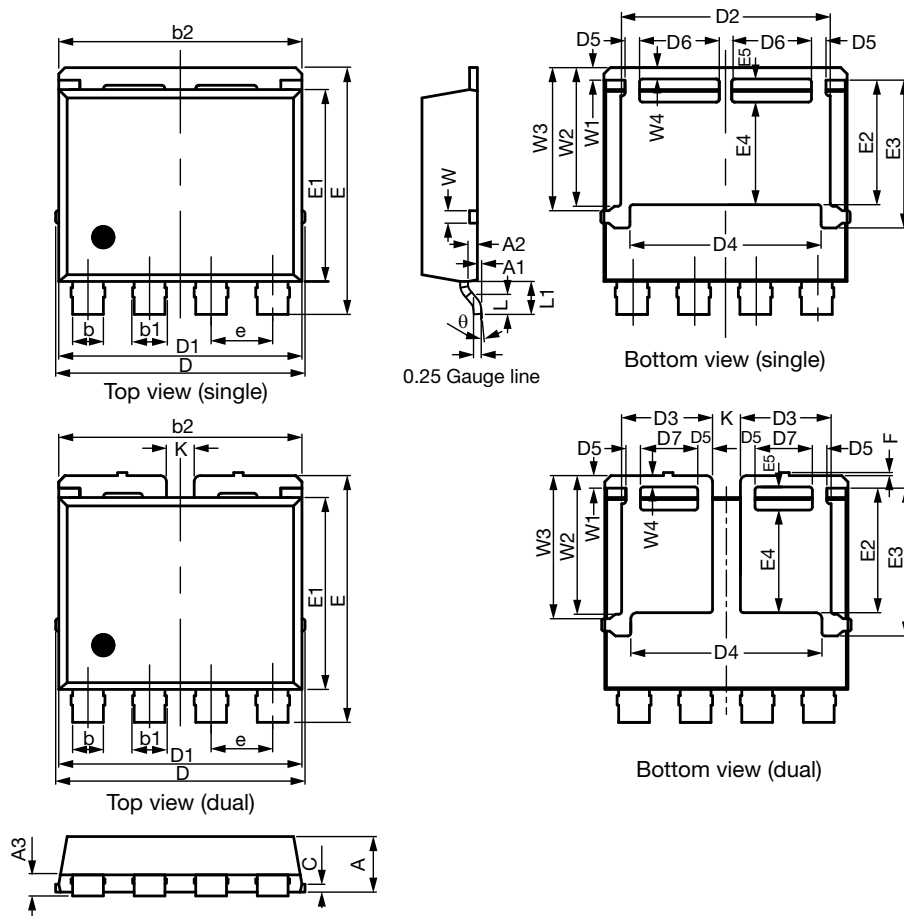
Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

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## PowerPAK® 8 x 8L Case Outline

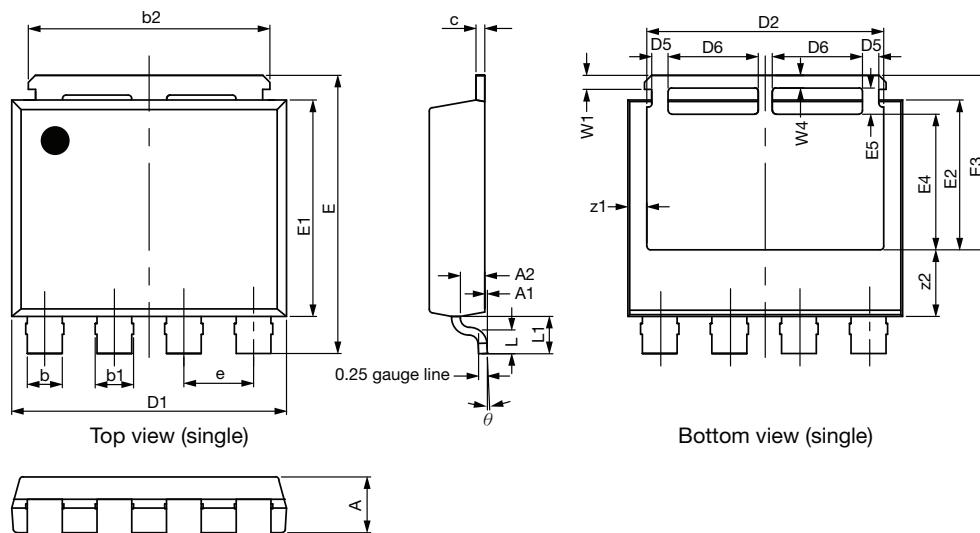


| DIM. | MILLIMETERS |      |      | INCHES |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | MIN.        | NOM. | MAX. | MIN.   | NOM.  | MAX.  |
| A    | 1.70        | 1.80 | 1.90 | 0.067  | 0.071 | 0.075 |
| A1   | 0.00        | 0.08 | 0.13 | 0.000  | 0.003 | 0.005 |
| A2   | 0.25        | 0.30 | 0.35 | 0.010  | 0.012 | 0.014 |
| A3   | 0.55        | 0.62 | 0.70 | 0.022  | 0.024 | 0.028 |
| b    | 0.92        | 1.00 | 1.08 | 0.036  | 0.039 | 0.043 |
| b1   | 1.02        | 1.10 | 1.18 | 0.040  | 0.043 | 0.046 |
| b2   | 7.80        | 7.90 | 8.00 | 0.307  | 0.311 | 0.315 |
| c    | 0.20        | 0.25 | 0.30 | 0.008  | 0.010 | 0.012 |
| D    | 8.00        | 8.10 | 8.25 | 0.315  | 0.319 | 0.325 |
| D1   | 7.80        | 7.90 | 8.00 | 0.307  | 0.311 | 0.315 |
| D2   | 6.70        | 6.80 | 6.90 | 0.264  | 0.268 | 0.272 |
| D3   | 2.85        | 2.95 | 3.05 | 0.112  | 0.116 | 0.120 |
| D4   | 6.11        | 6.21 | 6.31 | 0.241  | 0.244 | 0.248 |
| D5   | 0.37        | 0.47 | 0.57 | 0.015  | 0.019 | 0.022 |
| D6   | 2.49        | 2.59 | 2.69 | 0.098  | 0.102 | 0.106 |
| D7   | 1.76        | 1.86 | 1.96 | 0.069  | 0.073 | 0.077 |



| DIM.                                    | MILLIMETERS |      |      | INCHES |       |       |
|-----------------------------------------|-------------|------|------|--------|-------|-------|
|                                         | MIN.        | NOM. | MAX. | MIN.   | NOM.  | MAX.  |
| e                                       | 1.95        | 2.00 | 2.05 | 0.077  | 0.079 | 0.081 |
| E                                       | 7.90        | 8.00 | 8.10 | 0.311  | 0.315 | 0.319 |
| E1                                      | 6.12        | 6.22 | 6.32 | 0.241  | 0.245 | 0.249 |
| E2                                      | 3.94        | 4.04 | 4.14 | 0.140  | 0.159 | 0.163 |
| E3                                      | 4.69        | 4.79 | 4.89 | 0.185  | 0.189 | 0.193 |
| E4                                      | 3.23        | 3.33 | 3.43 | 0.127  | 0.131 | 0.135 |
| E5                                      | 0.65        | 0.75 | 0.85 | 0.026  | 0.030 | 0.033 |
| F                                       | 0.00        | 0.10 | 0.15 | 0.000  | 0.004 | 0.006 |
| L                                       | 0.62        | 0.72 | 0.82 | 0.024  | 0.028 | 0.032 |
| L1                                      | 0.92        | 1.07 | 1.22 | 0.036  | 0.042 | 0.048 |
| K                                       | 0.80        | 0.90 | 1.00 | 0.031  | 0.035 | 0.039 |
| W                                       | 0.30        | 0.40 | 0.50 | 0.012  | 0.016 | 0.020 |
| W1                                      | 0.30        | 0.40 | 0.50 | 0.012  | 0.016 | 0.020 |
| W2                                      | 4.39        | 4.49 | 4.59 | 0.173  | 0.177 | 0.181 |
| W3                                      | 4.54        | 4.64 | 4.74 | 0.179  | 0.183 | 0.187 |
| W4                                      | 0.32        | 0.37 | 0.42 | 0.013  | 0.015 | 0.017 |
| θ                                       | 6°          | 10°  | 14°  | 6°     | 10°   | 14°   |
| C17-1388-Rev. B, 16-Oct-17<br>DWG: 6026 |             |      |      |        |       |       |

## PowerPAK® 8 x 8L BWL Case Outline 2



| DIM. | MILLIMETERS |       |       | INCHES |       |       |
|------|-------------|-------|-------|--------|-------|-------|
|      | MIN.        | NOM.  | MAX.  | MIN.   | NOM.  | MAX.  |
| A    | 1.50        | 1.60  | 1.70  | 0.059  | 0.063 | 0.067 |
| A1   | 0.00        | -     | 0.127 | 0.000  | -     | 0.005 |
| A2   | 0.655       | 0.705 | 0.755 | 0.026  | 0.028 | 0.030 |
| b    | 0.92        | 1.00  | 1.08  | 0.036  | 0.039 | 0.043 |
| b1   | 1.02        | 1.10  | 1.18  | 0.040  | 0.043 | 0.046 |
| b2   | 6.84        | 6.94  | 7.04  | 0.269  | 0.273 | 0.277 |
| c    | 0.20        | 0.25  | 0.30  | 0.008  | 0.010 | 0.012 |
| D1   | 7.80        | 7.90  | 8.00  | 0.307  | 0.311 | 0.315 |
| D2   | 6.70        | 6.80  | 6.90  | 0.264  | 0.268 | 0.272 |
| D5   | 0.37        | 0.47  | 0.57  | 0.015  | 0.019 | 0.022 |
| D6   | 2.49        | 2.59  | 2.69  | 0.098  | 0.102 | 0.106 |
| e    | 1.97        | 2.00  | 2.03  | 0.078  | 0.079 | 0.080 |
| E    | 7.90        | 8.00  | 8.10  | 0.311  | 0.315 | 0.319 |
| E1   | 6.12        | 6.22  | 6.32  | 0.241  | 0.245 | 0.249 |
| E2   | 4.21        | 4.31  | 4.41  | 0.166  | 0.170 | 0.174 |
| E3   | 4.92        | 5.02  | 5.12  | 0.194  | 0.198 | 0.202 |
| E4   | 3.80        | 3.90  | 4.00  | 0.150  | 0.154 | 0.157 |
| E5   | 0.65        | 0.75  | 0.85  | 0.026  | 0.030 | 0.033 |
| L    | 0.61        | 0.68  | 0.75  | 0.024  | 0.027 | 0.030 |
| L1   | 1.00        | 1.07  | 1.15  | 0.039  | 0.042 | 0.045 |
| W1   | 0.30        | 0.40  | 0.50  | 0.012  | 0.016 | 0.020 |
| W4   | 0.32        | 0.37  | 0.42  | 0.013  | 0.015 | 0.017 |
| z1   | 0.45        | 0.55  | 0.65  | 0.018  | 0.022 | 0.026 |
| z2   | 1.81        | 1.91  | 2.01  | 0.071  | 0.075 | 0.079 |
| θ    | 0°          | -     | 5°    | 0°     | -     | 5°    |

ECN: S19-0643-Rev. B, 05-Aug-2019  
DWG: 6073

### Note

- Millimeter will govern



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